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Proceedings of the 8th Annual Integrated Crop
Management Conference

Nov 20th, 12:00 AM

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Owen, Micheal D. K., "Weed Management Update" (1996). *Proceedings of the Integrated Crop Management Conference*. 30.
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WEED MANAGEMENT UPDATE

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Introduction

Generally, the 1996 crop year was better than early indications suggested. However, there were numerous problems, concerns, and management decisions that, if resolved or improved would have dramatically improved crop health and weed management in specific fields. Also of importance are new products that may be available for weed management in 1997. Finally, some aspects of weed management, specific weeds, and application problems will likely be significant problems in 1997. This paper will describe these situations and provide some discussion concerning strategies to resolve the problems.

Herbicide drift

Herbicide drift was a significant problem again in 1996. While other issues in agriculture have received more attention the last few years, herbicide drift continues to be an increasing problem. Consider that essentially all crop acres are treated at least once with a herbicide(s), and a large percentage of acres treated more than once. Given the limitations of equipment availability, weather conditions, the critical nature of application timing, and the herbicides used, herbicide drift is an inevitable consequence of current weed management strategies. However, current concerns about the environment and the general perception of agriculture by the public will likely result in restrictions on applications thus hindering weed management unless adjustments are made by applicators. These concerns about herbicide drift focused on Roundup in 1996, but all herbicides drift and thus these concerns must be addressed by the entire agricultural community.

There are several points about herbicide drift that must be considered. Notably, when the environmental conditions limit the days available for field work, herbicide applicators are under extreme pressure to spray even when conditions may enhance drift. Further, the demand for custom applications have overwhelmed the equipment and personnel available within this industry. Thus, in order to treat the acres, custom applicators may make herbicide applications when conditions are less than appropriate. Importantly, while there are some equipment modifications and adjustments that will reduce the potential for herbicide drift, custom applicators may not have the flexibility to make these changes with their equipment. Thus, the only real drift management strategy that all custom applicators have is to determine when they make the applications. If conditions favor drift, applications should be terminated. While the industry may rationalize that applications must occur regardless of conditions in order to meet the demand, this position will be increasingly less acceptable.

Herbicide injury

Herbicide injury was a significant factor in crop production during 1996. Unfortunately, many instances of herbicide injury were not discovered until harvest. While 1996 environmental conditions interacted with herbicides to enhance the potential herbicide phytotoxicity, crop damage is anticipated for 1997 given the herbicide use strategies. There are a number of management decisions that effect the occurrence of herbicide injury. The reader is also directed to the paper titled "Crop Responses to Herbicides" authored by Bob Hartzler that appears in this proceedings.

Choice of herbicide is an important consideration. As a general statement, ALS inhibiting herbicides and growth regulator herbicides have a closer tolerance in crops than other types of herbicides. Consider that interactions between different herbicides may also be a factor in the development of herbicide injury. Unfortunately, there has been little experimental evidence supporting the occurrence of herbicide interactions. Most of the evidence that describes interactions is qualitative and based on observations made in grower fields. Importantly, there appears to be a significant affect of environmental and soil conditions on the development of symptoms. The inclusion of a herbicide additive can also increase the potential for crop injury. This may be significant when growth regulator herbicides are applied in combination with other herbicides.

Application timing and technique also impact the occurrence of herbicide injury. For example, early post/delayed preemergence applications have resulted in significant injury for combinations of growth regulator herbicides applied in combination with ALS inhibiting herbicides. ALS inhibiting herbicides that are applied late postemergence have caused significant injury and loss of yield. Unfortunately, there appears to be a growing trend to delay postemergence applications. Also a concern is the trend to make multiple applications of herbicides within the same growing season. Again, these may interact causing serious crop injury.

Waterhemp

Waterhemp continues to be an increasing problem in Iowa and the Midwest. Part of the rapid increase in waterhemp populations is due to the repeated applications of ALS inhibitor herbicides and the development of resistant biotypes. However the main factors are the reduced use of herbicides that control waterhemp (ie. dinitroanilines), applications of reduced rates of herbicides, earlier applications of residual herbicides, attempts to control waterhemp with late postemergence applications, the increased acreage in conservation tillage, reduced use of mechanical weed management strategies, and a tendency for waterhemp to germinate later in the growing season.

Waterhemp will continue to be a major problem because growers are not willing to manage the weed properly. Due to the biology of waterhemp, management strategies must be multifaceted. A planned program of residual herbicides, mechanical techniques, and enhanced cultural control will provide acceptable control of waterhemp. Sole reliance on herbicides will result in poor waterhemp control.

Woolly cupgrass

Woolly cupgrass also continues to be a problem in Iowa and has expanded the territory in which infestations occur. Unlike the waterhemp, woolly cupgrass demonstrates both biological characteristics and biochemical tolerance, relative to other annual grass weeds, increasing the difficulty of control.

Thus, diverse management strategies and timely implementation of the strategies is critical for woolly cupgrass. Even when properly planned and implemented, the potential for less than acceptable control is quite high for woolly cupgrass.

There is no single herbicide that will consistently control woolly cupgrass at an economically acceptable level. Further, multiple herbicide applications may improve the consistency of control but will also significantly increase the risk of crop injury and may not be cost-effective. The key to a woolly cupgrass management program is the timely use of mechanical strategies. Without cultivation, it is extremely difficult and costly to manage woolly cupgrass. A diverse management plan is critical for woolly cupgrass control.

New products

There are a number of new products currently under development by agricultural chemical companies. Many of these products demonstrate important advances in weed management opportunities. A brief discussion of products that are most likely to receive registration in 1997 follows. The exclusion of products does not constitute a lack of endorsement, nor does inclusion in this paper represent a recommendation.

Authority (sulfentrazone) is under development by FMC for weed control in soybeans. Authority can be applied to the soil (PE or PPI) and will provide control of many broadleaf weeds including morningglories, pigweeds, waterhemp, and common lambsquarters. However, common cocklebur is not controlled by Authority. Authority will likely be used in combination with other herbicides.

Axiom is a prepackage mixture of thiaflumide (proposed common name) and metribuzin that will be registered for soil application in corn and soybeans. Axiom will provide control of many annual grasses and small seeded broadleaf weeds. Axiom demonstrates good residual activity and is moderately mobile in soil.

Balance (isoxaflutole, proposed common name) is under development by Rhone Poulenc for soil-applied weed control in corn. Balance inhibits pigment biosynthesis in sensitive crops and affected weeds appear white in color. While Balance is primarily active on broadleaf weeds, it also has activity on some annual grasses. In 1996 under wet conditions, Balance demonstrated woolly cupgrass activity, however there were also instances of corn phytotoxicity. Sensitive broadleaf weeds include common ragweed, smartweed, velvetleaf, pigweeds, and black nightshade.

Liberty (glufosinate) is a nonselective herbicide marketed by AgrEvo for use in glufosinate resistant corn and soybeans. Liberty has a different mechanism of action than Roundup and demonstrates activity quicker on sensitive weeds. Liberty does not exhibit residual activity, thus a weed management strategy with Liberty must include mechanical control, multiple applications, or residual herbicides. The more diverse the management plan, the better and more consistent the weed control.

Lightning is a prepackage mixture of imazethapyr (Pursuit) and imazapyr (Arsenal) currently under development by American Cyanamid. Lightning will be used as a postemergence application on IMI-Corn TM hybrids. Lightning will primarily control annual broadleaf weeds including giant ragweed, velvetleaf, and common cocklebur. Weeds that are less sensitive to Lightning are common ragweed, common lambsquarters, and common waterhemp (particularly ALS resistant biotypes). Importantly, Lightning has demonstrated considerable activity on woolly cupgrass.

Roundup Ultra (glyphosate) is a relatively new formulation introduced in 1996 by Monsanto. Generally, Roundup Ultra is the same as Roundup with the exception that additives are included in the formulation. Roundup Ultra demonstrates the same weed spectrum that previous Roundup products demonstrated and also has similar physicochemical properties. Specifically, the vapor pressure of Roundup Ultra is similar to other Roundup formulations; Roundup Ultra does not readily volatilize and drift in vapor form. However, physical spray drift characteristics are similar to all other herbicides.

Steel is a prepackage combination of pendimethalin (Prowl), imazethapyr (Pursuit), and imazaquin (Scepter) introduced by American Cyanamid for soybean weed control primarily in Southern Iowa. Refer to the label for specific Iowa counties where Steel can be used without an 18 month rotational restriction for corn. Steel demonstrates broad spectrum control of annual grass and broadleaf weeds and can be applied early preplant (EPP), preemergence (PE) or preplant incorporated (PPI). Steel should not be applied after soybean emergence nor PE north of I-80. Iowa State University recommends that IMI-Corn[™] hybrids be planted the year following Steel applications.

Touchdown (sulfosate) is a nonselective herbicide introduced by Zeneca for use in corn and soybeans as a burndown product. Touchdown demonstrates activity similar to Roundup.

One-pass weed control

Current herbicide marketing has resulted in growers demanding one-pass weed control programs. Further, the expectations of growers relative to the level of weed control that is acceptable are also unrealistically high, again as a result of herbicide marketing campaigns and grower programs. One-pass weed control is certainly a worthy goal and is achieved by many growers. However, realistically, given current application trends (early applications, reduced rates, and postemergence herbicides without residual characteristics), conservation tillage systems, and changes in weed populations, growers must be cognizant that there are risks associated with one-pass weed control and should be ready to modify management strategies to resolve the problems soon after they develop. This requires that growers have improved management skills and utilize integrated weed management strategies. In many instances, the use of mechanical weed management strategies will represent the best options.

Fall applications

The use of fall herbicide applications continues to increase in Iowa and marketing has expanded the areas that are now targeted for this use. The rationales for fall applications are increased efficiency in time and equipment utilization. While Iowa State University does not endorse nor recommend this application strategy, there are an increasing number of custom applicators making these applications. Iowa State University personnel recognize the successes experienced by many growers, but must point out that this application technique has more risk of unacceptable performance, particularly later in the growing season, than other applications. While there are some environmental considerations about fall applications, these concerns are currently under study and have not been assessed. If fall applications of labeled herbicides are included in a weed management program, growers should recognize the inherent risks of variable control later in the season and be prepared to supplement the fall applications with appropriate remedial weed management strategies.

Exceed carryover

Exceed carryover to soybeans was experienced in Northern Iowa in 1996. Research conducted by Iowa State University on high pH soils demonstrated a consistent rate response to soybeans the two years that the experiments were conducted. However, no yield response was detected. Grower experiences in 1996 suggest that variability in the field, environmental factors, and application timings in 1995 may have contributed to the severe responses observed. If Exceed was applied in 1996 and soybeans are to be planted in 1997, there are some strategies to minimize the risk of soybean injury. The risk of Exceed carryover is greatest on high pH soils. If the growing season appears to be one that will cause stress on the developing crop, it may be appropriate to plant corn instead of soybeans. If changing rotation plans is not an option, delay planting into the fields until environmental conditions improve and the crop can develop quicker. It may be appropriate to use herbicides other than ALS inhibitors on the soybeans as there is potential for interactions. Finally, there is some qualitative evidence that STS soybeans may be less sensitive to Exceed.

Herbicide resistant crop technologies

The use of herbicide resistant crops (HRC's) continues to receive considerable attention by the media, growers, and the general public. Most noteworthy is the use of Roundup Ready soybeans and Roundup Ultra as a weed management system. However, other HRC's such as STS soybeans, IMI-Corn™ hybrids, Liberty Link systems, SR corn hybrids, and others will play an important role in weed management. Growers must recognize that these HRC technologies represent components of a weed management program, and not cure-alls. For example, while SR corn hybrids will be extremely important in areas infested with woolly cupgrass, wirestem muhly, or quackgrass, Poast Plus (sethoxydim) will not control these weeds consistently if it is the only strategy used.

There are other risks associated with HRC weed management strategies. For example, the use of nonselective herbicides in HRC corn hybrids and soybean varieties seems to be an extremely simple system. However, the grower must be prepared to understand the relationship between crops and weeds in order to identify the proper application timing. This requires an intuitive decision about the relative competitive ability of a mixed weed population, an assessment of environmental conditions, proper identification of the weed species, selection of a herbicide rate based on weed species and size, and the ability to apply the herbicide in a timely fashion. Delayed applications may result in loss of potential yield due to weed interference or poor control of existing weed populations. Further, as these herbicides do not have residual characteristics, multiple applications of the nonselective herbicides may be required. Multiple applications represents an increased risk of drift to sensitive crops and plants.

Options to minimize these risks include the use of residual herbicides for initial weed control, thus providing the grower with greater time flexibility when making the postemergence application, the inclusion of mechanical weed control (rotary hoeing in the case of narrow row soybean production systems), and directed application equipment.

In some instances, the use of HRC's increases the risk of herbicide resistant weeds populations. Where repeated use of herbicides with similar mechanisms of action are a result of HRC's, the selection pressure on the weed population increases the potential for the resistant individuals to become the predominant part of the weed population. Common waterhemp populations that are resistant to ALS inhibiting herbicides could be, in part, a result of HRC's and repeated use of ALS-inhibiting herbicides.

Conclusions

While there were a number of problems experienced in 1996, in general, there does not appear to be a great concern for 1997. However, if conditions in the early spring, 1997 stress the seedling crops, adjustments should be made. Risks of herbicide injury to crops, poor performance of herbicides, and interactions with other herbicides increases when stress conditions exist. Modifying weed management plans will help resolve these risks and will improve weed control while minimizing risks.